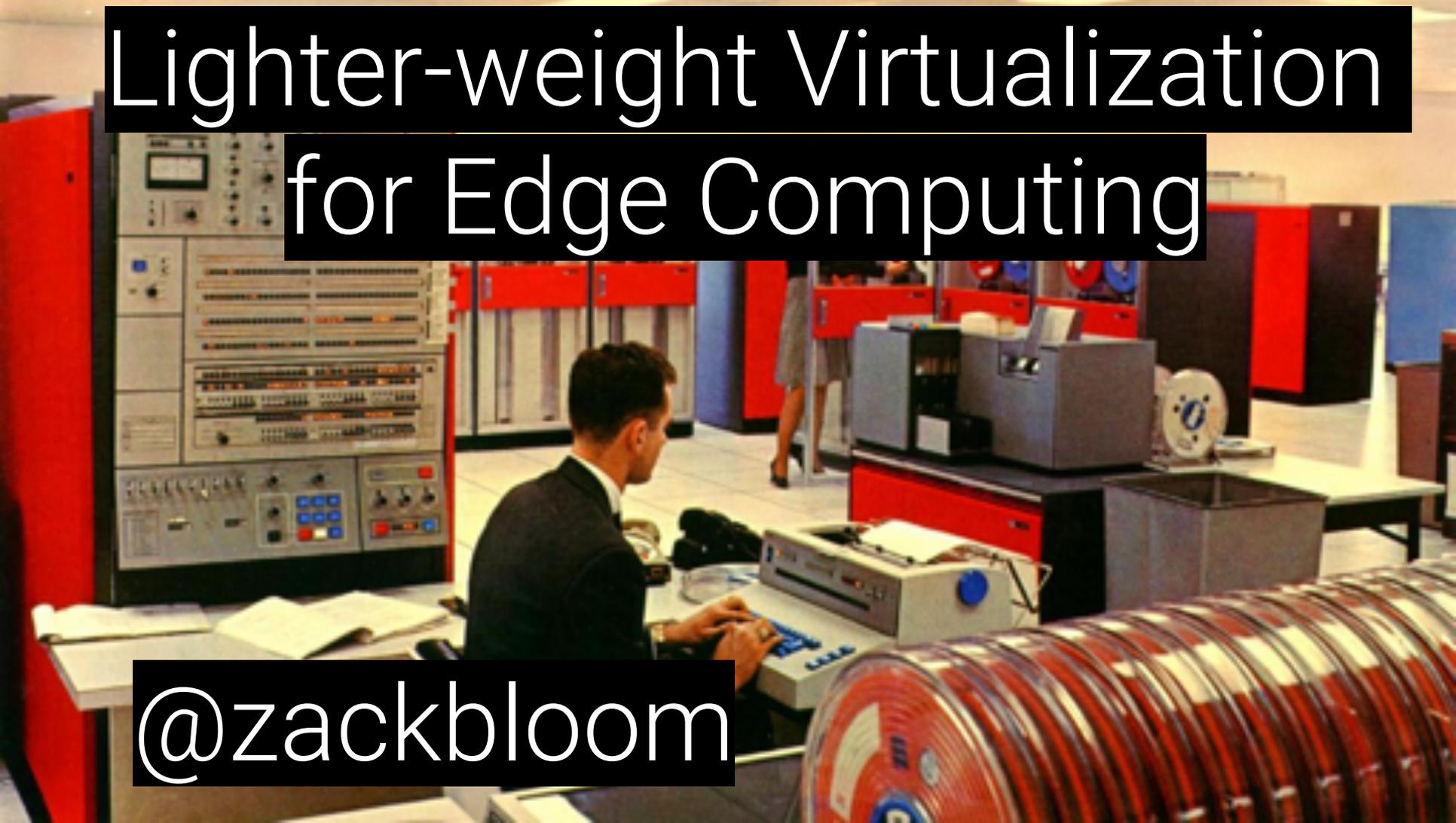
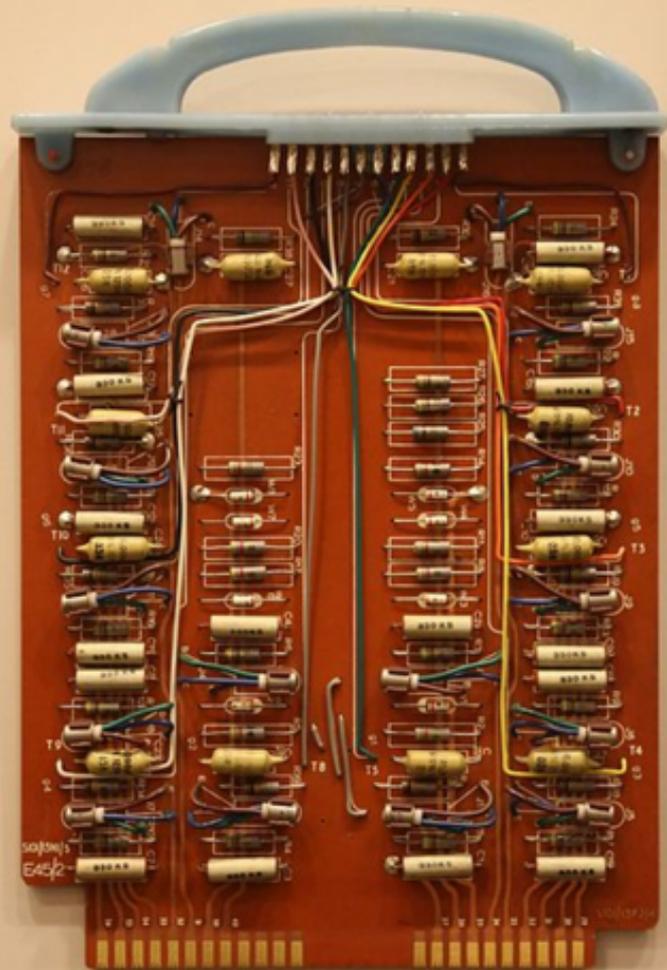
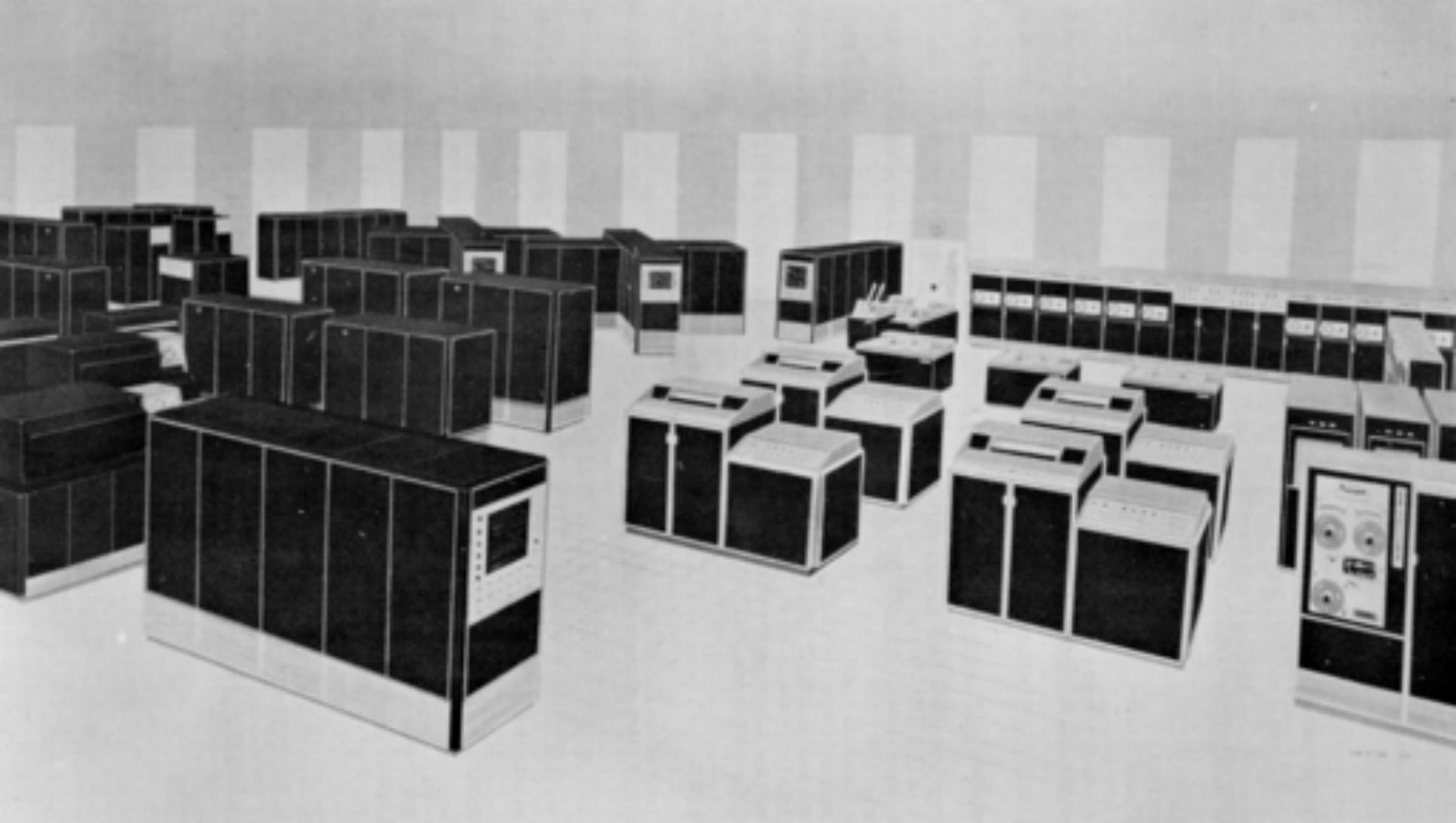


# Lighter-weight Virtualization for Edge Computing

A man in a dark suit is seated at a desk, typing on a vintage computer keyboard. The desk is cluttered with papers and a small printer. In the background, there are several large, rack-mounted computer units with various dials and switches. To the right, there are more computer components, including a large roll of magnetic tape in the foreground. The room has a red wall and a blue wall in the background.

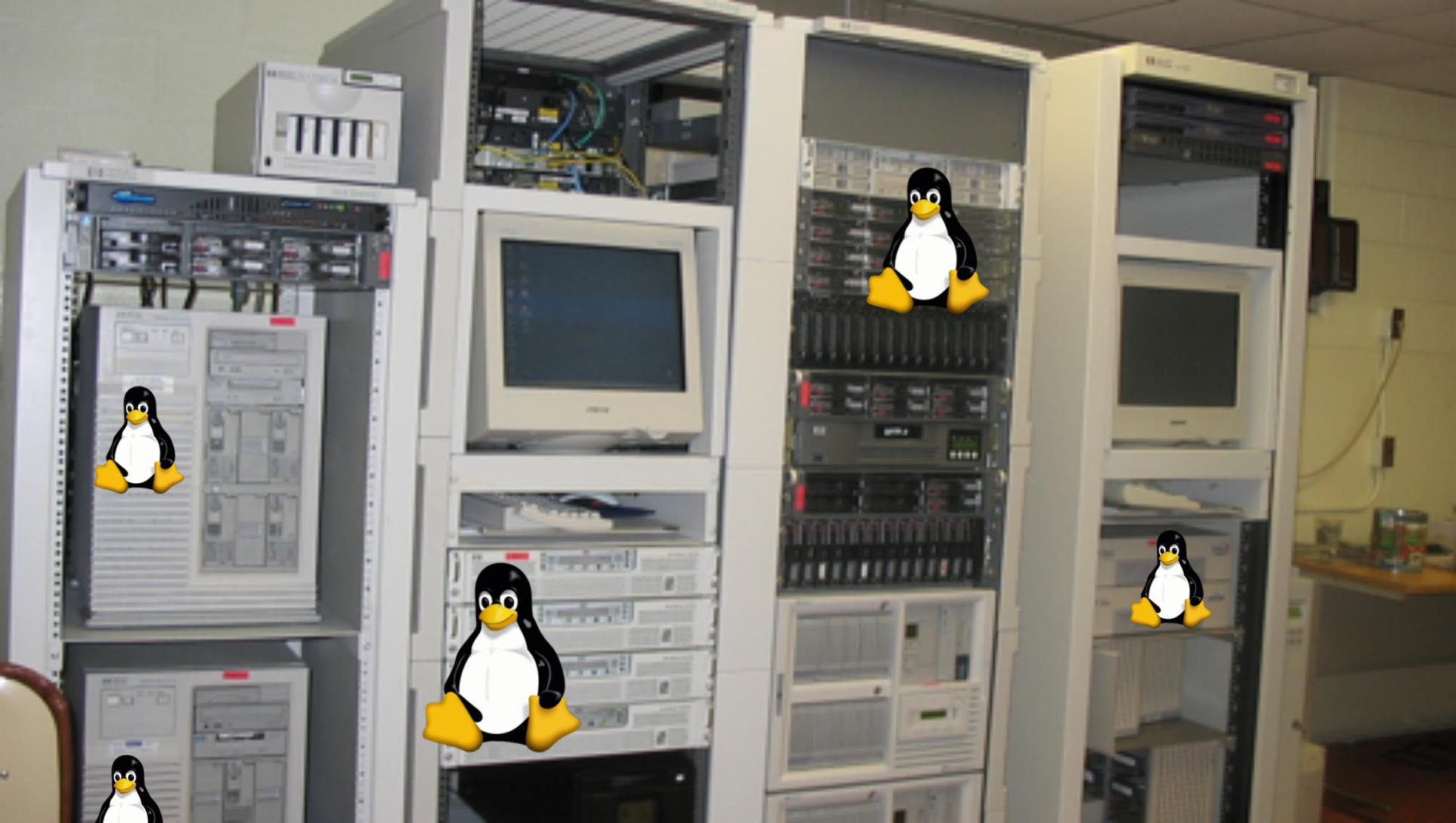
@zackbloom











Xen Domain  
Manager (Dom0)

Xen Guest  
OS 1

Xen Guest  
OS 2

.....

Xen Guest  
OS n



Xen Hypervisor Layer

Physical Hardware

## Xen Virtualization Architecture

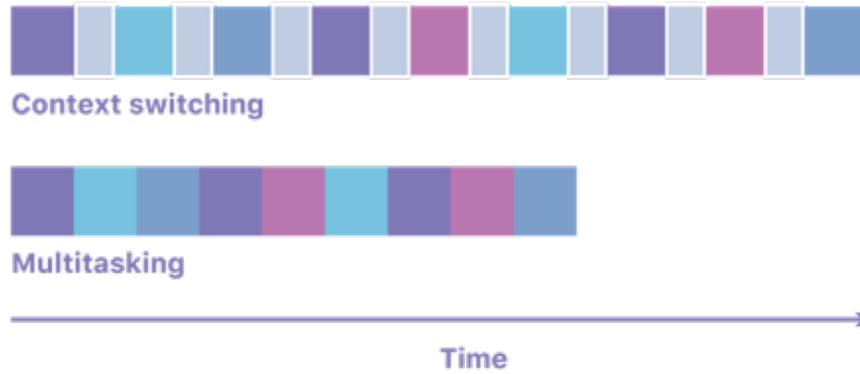




+ Easy Way to  
Run Functions  
+ Autoscaling



Every Serverless Function  
has its own container, its  
own process.



10 uS per context switch \* 100,000 requests per second  
= 1 CPU second spent... every second

**No actual work is getting done**

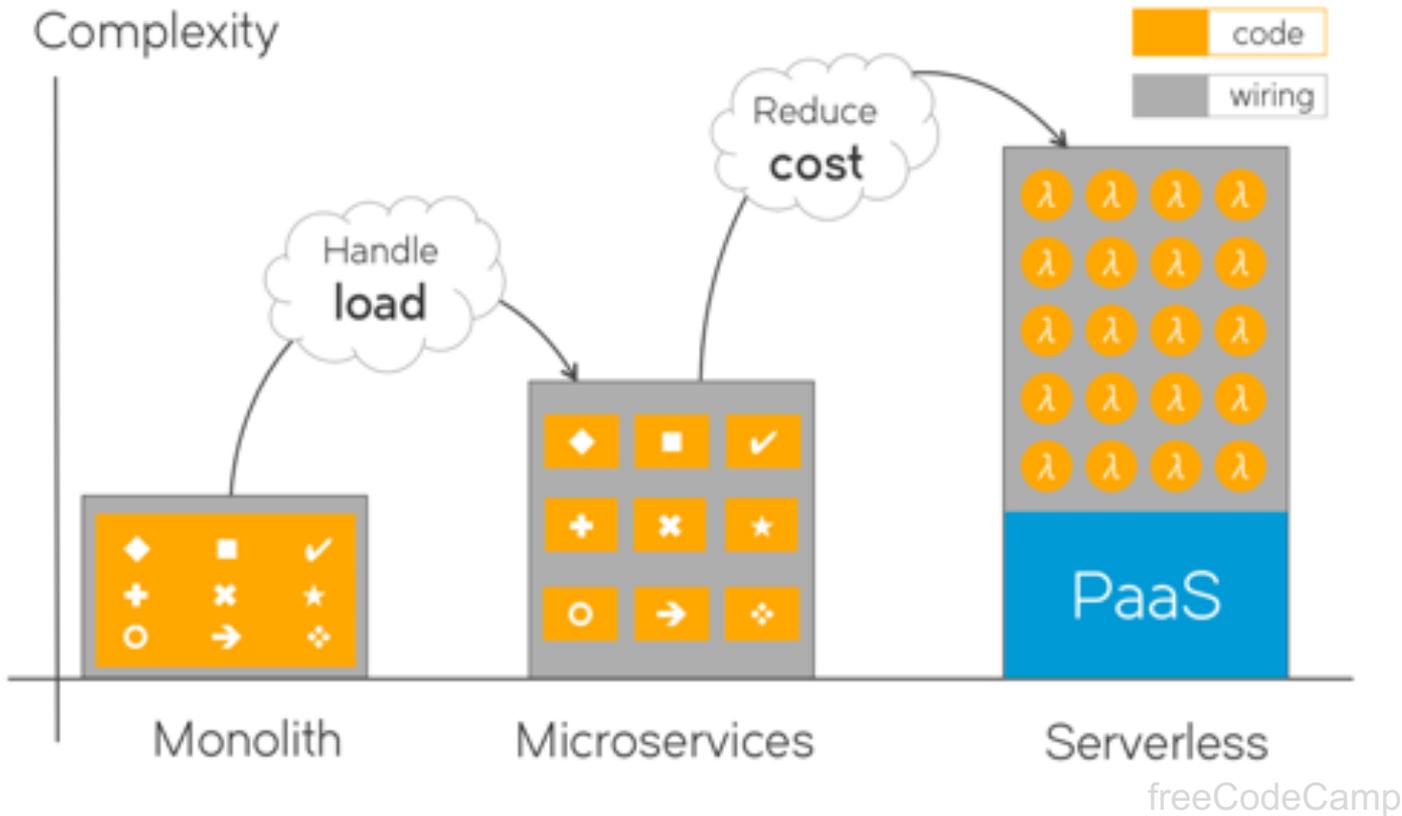


ComputerHope.com

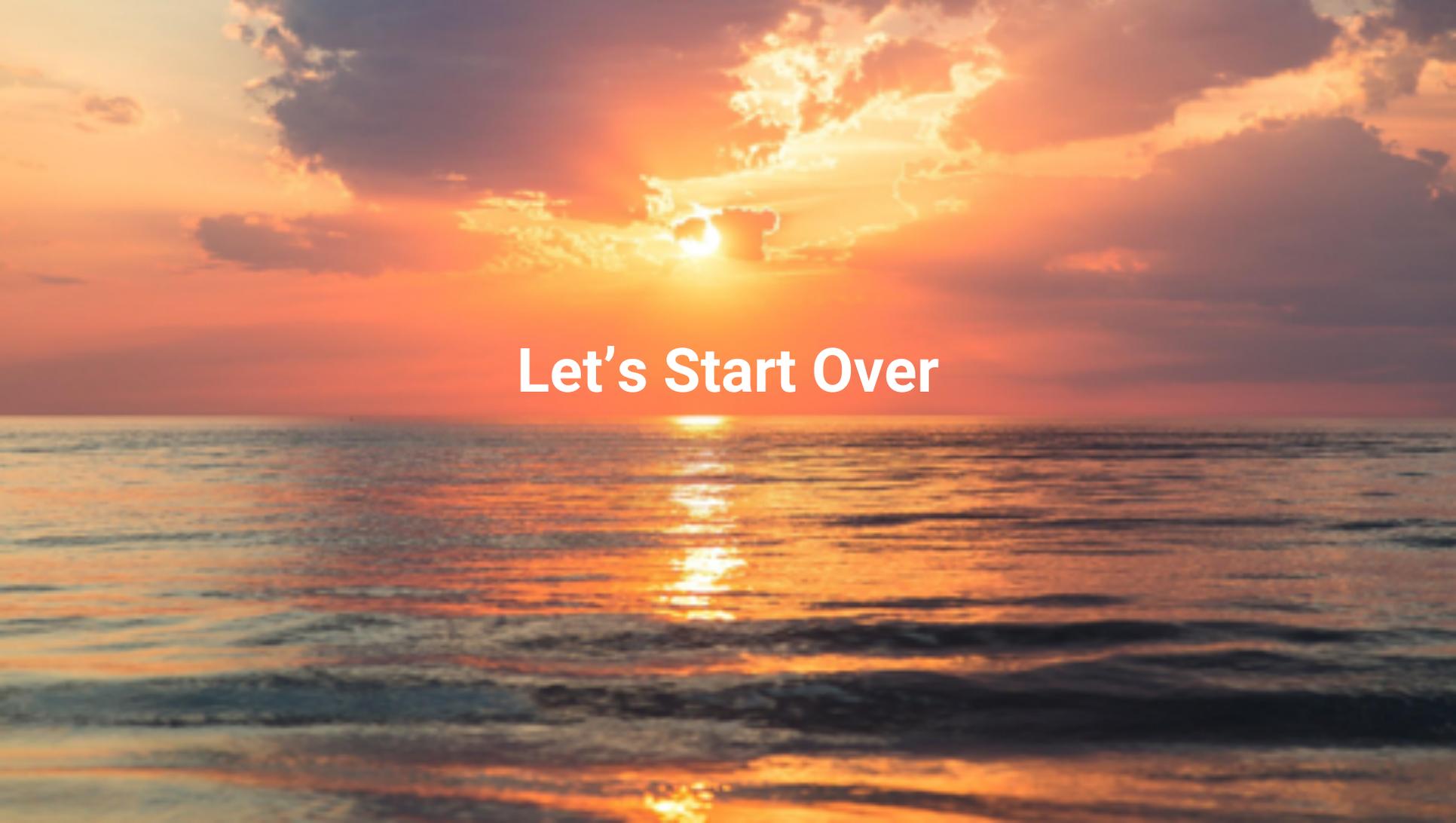
**~33% of time spent handling  
interrupts and security**



Cold Starts: It takes **500ms - 10s** to start a **Node Lambda**



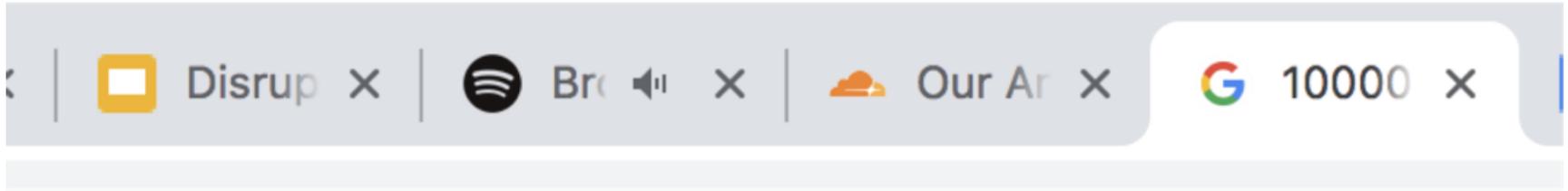
**A better developer experience built on forty year old tools**

A vibrant sunset over the ocean. The sun is low on the horizon, partially obscured by a large, dark cloud. The sky is filled with warm, golden light, and the sun's reflection creates a shimmering path across the water's surface. The overall mood is peaceful and hopeful.

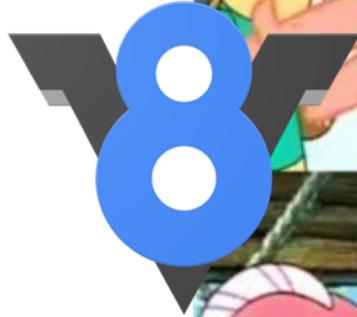
**Let's Start Over**

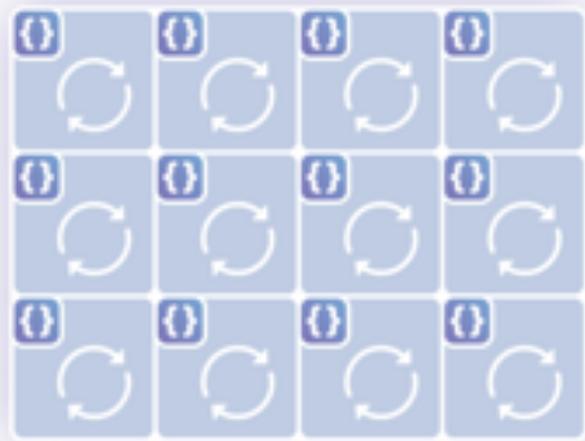
# Goals

- Run code on distributed machines, in a safe isolated way
- Consume only the memory required by our code
- Spend all of our CPU time on our code
- Make scaling across regions trivial

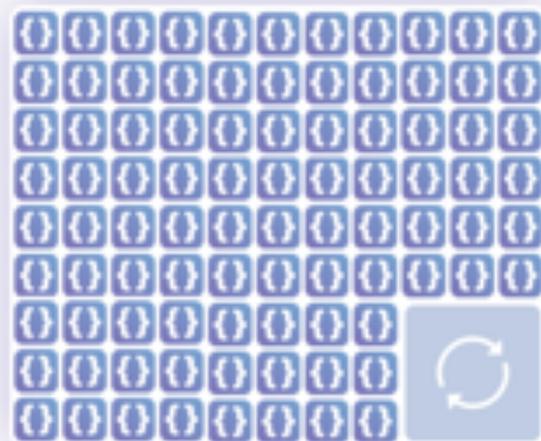


Runs untrusted isolated code  
Minimal memory overhead  
Starts running new code fast





Virtual machine



Isolate model



User code



Process overhead

No VMs

No Containers

Millions of Functions

- **3x More Compute** per \$
- **10x Less Memory** (35 MB -> 3 MB)
- **100x Lower Cold-Start Time**  
(500 ms -> 5 ms)

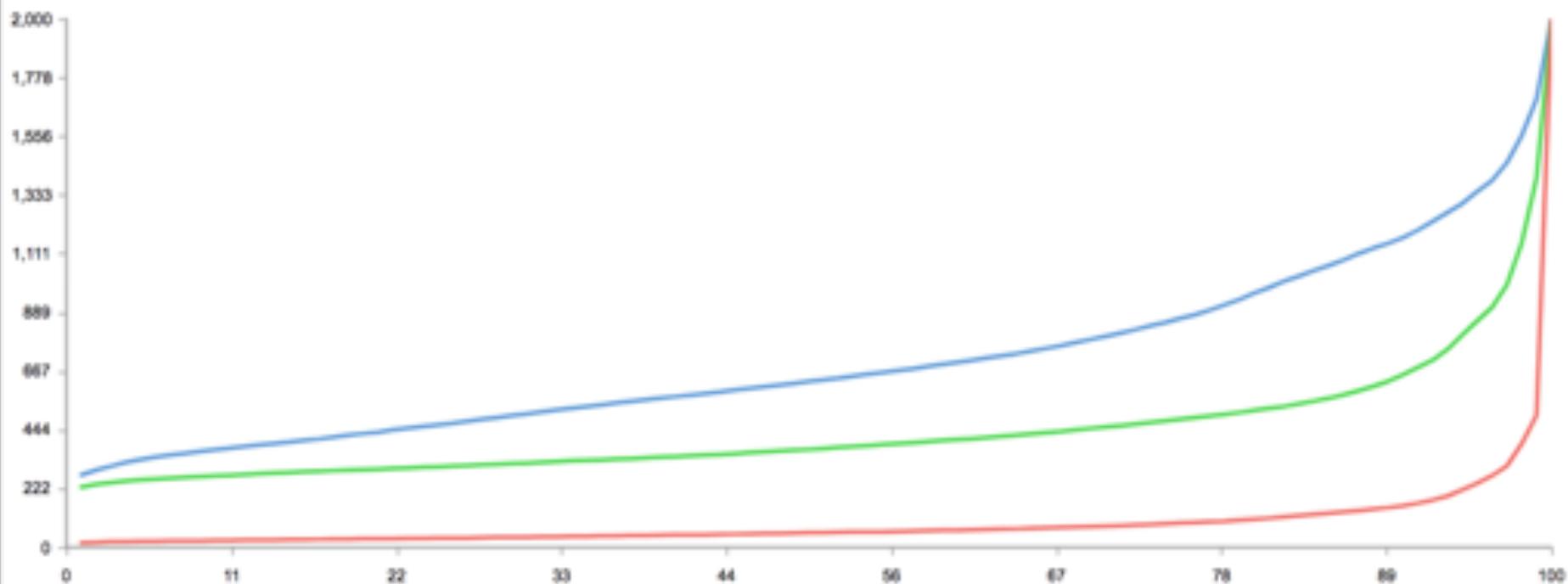
Functions start and scale in 5 ms



No Regions  
No Availability Zones  
Hundreds of Data Centers  
Instant Auto Scaling  
No Ops, No SRE

Test : ■ PBKDF2 - Lambda ■ PBKDF2 - Lambda@Edge ■ PBKDF2 - Worker

Webpage Response (ms)





The  
Future

Entire applications will run  
on 'the Internet'

# **Just Write Code.**

**<https://workers.cloudflare.com>**

**@zackbloom**